

CLAIMS

[1] A diaphragm pump comprising:

a pressure chamber formed into a flat shape and is filled up with liquid;

a suction side flow passage and a discharge side flow passage
5 disposed at both ends of the pressure chamber so that axes thereof are aligned with each other and are connected with the pressure chamber;

check valves, respectively disposed on the suction side flow passage and the discharge side flow passage, at least one of the check valves being tilted relative to the direction of the axes; and

10 at least one diaphragm disposed on at least one of an upper surface and a lower surface of the pressure chamber and for oscillation to make a volume of the pressure chamber variable.

[2] The diaphragm pump according to Claim 1, wherein the axes are positioned at the center of a cross-sectional shape of the pressure chamber in a surface orthogonal to the axes.

[3] The diaphragm pump according to Claim 1 or 2, wherein each cross-sectional shape of the pressure chamber, the suction side flow passage, and the discharge side flow passage in a surface orthogonal to the axes are formed in an approximate rectangle.

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[4] The diaphragm pump according to Claim 3, wherein a lower surface of the pressure chamber and the lower surfaces of the suction side flow

passage and the discharge side flow passage are formed on the same surface.

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[5] The diaphragm pump according to any one of Claims 1 through 4, wherein a length of the pressure chamber viewed from an upper surface in a direction orthogonal to the axes is continuously shortened toward the suction side flow passage or the discharge side flow passage.

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[6] The diaphragm pump according to any one of Claims 1 through 4, wherein a height of the pressure chamber is continuously lowered toward the suction side flow passage or the discharge side flow passage.

[7] The diaphragm pump according to any one of Claims 1 through 6, further comprising:

at least one groove formed in a peripheral wall of the pressure chamber and to be used for accelerating a flow of the liquid downstream in a flow direction.

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[8] The diaphragm pump according to Claim 7, wherein the groove has an a part with an opening in the upper surface facing the pressure chamber, into which the liquid flows, and a side opening part with an openings opened to a peripheral wall surface of the pressure chamber, from which the liquid is discharged downstream in the flow direction.

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[9] The diaphragm pump according to Claim 7 or 8, wherein the groove is extended in a radial direction while a point in the vicinity of an entrance of the

discharge side flow passage is set as the center.

[10] The diaphragm pump according to any one of Claims 1 through 9,
further comprising:

at least one intake opened to an upper surface of the suction side flow
passage and to introduce bubbles mixed in the liquid; and

5 a sealed space connected with the intake and to collect the introduced
bubbles.

[11] The diaphragm pump according to Claim 10, wherein the intake is
positioned in the suction side flow passage upstream relative to the check
valve.

[12] The diaphragm pump according to any one of Claims 1 through 11,
wherein the diaphragm is a piezoelectric oscillator driven by a piezoelectric
element.

5 [13] A cooling system comprising:

the diaphragm pump according to any one of Claims 1 through 12;

and

a closed-structure flow passage for circulating liquid discharged from
the discharge side flow passage in the diaphragm pump and for returning the
10 liquid to the suction side flow passage.